

Impact of temperature on plant performance and overhead line design

Knowledge type: Technology

Technology: Solar photovoltaic

Key learning

The design of overhead transmission lines must take into account the maximum ambient temperature that determines conductor sag (and therefore pole/line height requirements). Transmission lines are also designed to take into account maximum expected current (in this case, the current generated by the solar plant).

While it would be reasonable to assume that peak solar plant output would occur during periods of high solar radiation (which would imply high ambient temperatures), due to the thermal de-rating of photovoltaic (PV) modules with temperature, it is unlikely that the peak output of a solar plant will occur at the same time as the maximum ambient temperature. As a result, overhead transmission lines may not need to be designed for the condition in which peak plant output and maximum ambient temperature occurs at the same time.

Implications for future projects

When designing overhead transmission lines for future solar projects, it may be possible to reduce the pole height, which would be determined from a conservative calculation of maximum ambient temperature and maximum plant output. This may result in reduced construction costs for overhead transmission lines.

Background

Objectives or project requirements

AGL engaged an engineering, procurement and construction (EPC) contractor to design and construct the overhead transmission lines for the Nyngan Solar Plant. In addition, AGL engaged a technical consultant to review the EPC contractor's engineering design calculations and drawings. These calculations and drawings were also reviewed with the relevant Network Service Provider and regulatory authorities.

Process undertaken

For the Nyngan project, the EPC contractor submitted preliminary engineering design drawings and calculations to AGL. Through the process of engineering design and safety review, AGL and its technical consultant identified that the proposed design height of the transmission lines took into account both maximum ambient temperature and the maximum expected output of the solar plants. However, further calculations demonstrated that, due to the expected thermal de-rating of PV modules with increasing temperature, the maximum plant output was unlikely to occur at the same time as maximum ambient temperature. As such, it was determined that the design pole heights for Nyngan could be safely reduced, resulting in a small cost savings.